



**Public Water Supply  
Survival Guide  
for the  
Stage 1 Disinfectants and  
Disinfection Byproducts Rule**

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An “Acronyms and Definitions” list is provided as an aid to using this “Survival Guide.”

**Section 1** provides a summary of the Stage 1 DDBP Rule and a timetable for compliance. Each requirement listed in the timetable is cross-referenced to the applicable state and federal rules, the applicable sections of this document, and the applicable references to EPA guidance manuals.

**Section 2** describes the requirements associated with the new ceilings on disinfectant residual concentrations (MRDLs). This section applies to all CWSs and NTNCWSs that practice disinfection. It also applies to transient systems that practice disinfection with chlorine dioxide.

**Section 3** outlines the MCLs for DBPs, describes monitoring requirements (as well as opportunities for reduced monitoring), and explains compliance calculations and reporting requirements.

**Section 4** provides the DBP precursor (TOC) removal requirements for surface water and GWUDI systems that practice conventional filtration (coagulation which may be followed by a sedimentation step, filtration, and disinfection).

**Section 5** explains KDHE’s policies and procedures that will be used in meeting the reporting and recordkeeping requirements, and special primacy requirements, which will be observed by KDHE in implementing the Stage 1 DDBP Rule.

**Section 6** lists KDHE approved methods for measuring disinfectant residuals in systems and provides sample forms and calculation methods, as well as an EPA Quick Reference Guide.

# OVERVIEW

This guidance document is provided by the State of Kansas as a “quick reference guide” to assist Public Water Supply Systems in complying with the Disinfectants and Disinfection Byproducts Rule (Stage 1 DDBP Rule) requirements contained in the Kansas Primary Drinking Water Regulations. It presents a summary of the applicable regulatory requirements associated with the Stage 1 DDBP Rule promulgated by the Environmental Protection Agency (EPA) on December 16, 1998, which has been primarily adopted by the Kansas Department of Health and Environment (KDHE). This guidance provides a summary of the applicable requirements and the dates by which the requirements must be met. It is a basic “what and when” summary for all public water systems. While all systems should feel comfortable using this document as a complete and accurate summary of Stage 1 D/DBP requirements, the applicable full legal language is contained in the Kansas Administrative Regulations in conjunction with the Code of Federal Regulation which KDHE has adopted by reference.

This survival guide applies to:

**Systems:** CWSs, NTNCWSs, TNCWSs

**Sources:** All sources

**Persons Served:** All sizes

**Treatment:** All treatments

Specific questions regarding the information contained in this document, the Kansas Primary Drinking Water Regulations, or any other matters pertaining to drinking water and public water supply systems in Kansas should be directed to

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[www.kdhe.state.ks.us](http://www.kdhe.state.ks.us)

With the exception of the KDHE policies described in Section 5, reference is made to EPA guidance documents for specific details. Full citations to EPA manuals are given in the preface, along with shortened names by which these publications are identified whenever they are cited in this “Survival Guide”. KDHE staff, public water supply system officials, and other interested parties can refer to these documents when examining the specific details of the Stage 1 Disinfectants and Disinfection Byproducts Rule.

## ACRONYMS

**ACC** - Alternative Compliance Criteria

**BAT** - Best Available Technology

**KDHE** - Kansas Department of Health and Environment

**CFR** - Code of Federal Regulations

**CWS** - Community Water System

**D/DBP** - Disinfectants and disinfection byproducts

**D/DBPR** - Disinfectants and Disinfection Byproducts Rule

**DBPs** - Disinfection Byproducts

**DBPP** - Disinfection Byproducts Precursor

**DOC** - Dissolved Organic Carbon

**EPA** - United States Environmental Protection Agency

**GAC10** - Granular activated carbon adsorption with a 10 minute empty bed contact time

**GWUDI** - Ground Water Under the Direct Influence of Surface Water

**HAA5** - Sum of five haloacetic acids (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid)

**MCL** - Maximum Contaminant Level

**MCLG** - Maximum Contaminant Level Goal

**mg/L** - Milligrams per liter or parts per million (ppm)

**MRDL** - Maximum Residual Disinfectant Level (as mg/L)

**MRDLG** - Maximum Residual Disinfectant Level Goal

**NCWS** - Non-Community Water System

**NTNCWS** - Non-Transient Non-Community Water System

**PWS** - Public Water System

**SDWA** - Safe Drinking Water Act

**SOP** - Standard Operating Procedure

**SUVA** - Specific Ultraviolet Absorbance

**TNCWS** - Transient Non-Community Water System

**TOC** - Total Organic Carbon

**TTHMs** - Total trihalomethanes (Sum of chloroform, bromoform, chlorodibromomethane, and bromodichloromethane)

**µg/L** – Micrograms per Liter or parts per billion (ppb)

## DEFINITIONS

**KDHE:** The Kansas Department of Health and Environment is Kansas' primacy agency for the administration of the Safe Drinking Water Act. When the term "the State" is used in this survival guide, it refers to this agency.

**EPA:** The United States Environmental Protection Agency has federal oversight responsibility and authority regarding the administration and enforcement of the Safe Drinking Water Act. EPA prepares rules and technical / implementation guidance to implement the Safe Drinking Water Act through other agencies with primacy authority such as KDHE.

**GWUDI:** Systems utilizing "groundwater under the direct influence of surface water" (as previously determined by KDHE) are required to treat water from these sources as specified under the Surface Water Treatment Rule.

**IESWTR:** The Interim Enhanced Surface Water Treatment Rule, promulgated by EPA on December 16, 1998, is a companion rule to the Stage 1 Disinfection and Disinfection Byproducts Rule. The IESWTR established enhanced requirements for filtration of surface and GWUDI sources. These two rules have interrelated provisions; actions initiated under one rule have the potential to effect compliance under the companion rule.

**MCL:** Maximum contaminant levels specify upper limits on the concentration of drinking water contaminants established in Kansas Primary Drinking water Regulations.

**M/DBP Rules:** The term "M/DBP Rules" stands for "Microbial / Disinfection Byproduct Rules" and refers to the TCR, SWTR, IESWTR, LT1ESWTR, LT2ESWTR, Stage 1 DDBPR, Stage 2 DDBPR, FBRR, and GWR collectively.

**Stage 1 DDBP Rule:** The Stage 1 Disinfectants and Disinfection Byproducts Rule, promulgated by EPA on December 16, 1998, is a companion rule to the Interim Enhanced Surface Water Treatment Rule. The Stage 1 DDBP Rule established enhanced requirements on the monitoring and treatment of disinfectants and disinfection residuals in system distribution systems. These two rules have interrelated provisions; actions initiated under one rule have the potential to effect compliance under the companion rule.

**SWTR:** The Surface Water Treatment Rule, promulgated by EPA on June 29, 1989, was the precursor to enhanced requirements established under the Interim Enhanced Surface Water Treatment Rule and the Stage 1 Disinfectants and Disinfection Byproducts Rule. It established filtration and disinfection requirements that provide for continuous protection from pathological microbes potentially present in source waters.

**TCR:** The Total Coliform Rule, promulgated by EPA on June 29, 1989, was a precursor to enhanced requirements established under the Interim Enhanced Surface Water Treatment Rule and the Stage 1 Disinfectants and Disinfection Byproducts Rule. The TCR established health goals and legal limits for total coliform levels in drinking water (as indicator organisms), requires the conduct of routine sanitary surveys of systems, and specifies the type and frequency of testing which systems must perform.

# 1. Summary and Rule Compliance Timetable

## 1. A. Water Systems Affected by this Rule

This rule applies to all community and non-transient non-community public water systems that use a disinfectant for either primary or residual water treatment. Transient water systems that apply chlorine dioxide as a disinfectant must also comply.

## 1. B. General Requirements

The Stage 1 DDBP Rule contains the following major provisions:

1. Establishment of maximum disinfectant residual levels (MRDLs) for disinfectants in the distribution system. This is an upper limit on the concentration of disinfectants allowable during normal operating conditions. Water systems may exceed the MRDL for free chlorine and chloramines for the period necessary to address specific microbiological contaminant problems. The MRDL for chlorine dioxide may not be exceeded at any time.
2. Establishes standards for monitoring procedures. Chlorine or chloramines residual disinfectant concentrations must be measured in the distribution system at the same points in the distribution system and at the same time as total coliforms are sampled. There are no provisions for reduced monitoring. Compliance is based on a running annual arithmetic average. Violations require public notification. Sampling for chlorine dioxide is described later in this survival guide.
3. Establishment of Maximum Contaminant Levels (MCLs) for disinfection byproducts. The MCLs are
  - a. For systems using chlorine or chloramines in disinfection:
    - A group of 5 haloacetic acids (HAA5s) – 0.060 mg/l (**60 µg/L**)
    - Total trihalomethanes (TTHMs) - 0.080mg/l (**80 µg/L**)
  - b. For systems using chlorine dioxide:
    1. Chlorite – 1.0 mg/l
  - c. For systems using ozone:
    1. Bromate- 0.010 mg/l
4. Establishment of monitoring standards for disinfection byproducts. Each system is required to monitor for the disinfection byproducts of concern for their particular disinfectant. A monitoring plan must be prepared and kept in file for review. All

surface water and GWUDI systems serving more than 3,300 customers must submit their monitoring plan to KDHE; KDHE may require changes in the plan. Monitoring requirements vary with system size and type – reduced monitoring is available.

5. Establishment of TOC reduction requirements. Subpart H systems with conventional filtration treatment must use enhanced coagulation or enhanced softening to achieve reductions in total organic carbon in source waters, unless certain alternative compliance criteria are met. Determination of TOC removal requirements, or demonstrating that the system meets alternative compliance criteria, depends upon monitoring of source water TOC and alkalinity.
6. Establishment of reporting and recordkeeping requirements. Water systems are required to comply with KDHE's reporting and recordkeeping requirements, and KDHE is required to comply with EPA's reporting and recordkeeping requirements. Specific Health effects language is provided for purposes of public notification.
7. Establishment of state policies for records and interpretations / decisions regarding the Stage 1 DDBP Rule. KDHE has been required by EPA to develop and submit specific policies and procedures for certain aspects of recordkeeping and discretionary items of interpretation and decision making. These include
  - a. How KDHE will determine any interim treatment requirements for systems that have elected to install granular activated carbon or membrane filtration treatment and have been granted additional time to comply.
  - b. How KDHE will determine operator qualifications.
  - c. Approval of DPD colorimetric test kits for measuring disinfectant residuals and description of the qualifications that will be required of persons taking onsite measurements of these residuals.
  - d. Defining criteria to determine whether multiple wells are being drawn from the same aquifer and may be considered a single source for compliance with monitoring requirements.
  - e. How KDHE will approve certain alternative TOC removal requirements.

### 1. C. Timetable for the Stage 1 DDBP Rule

Date	Rule Requirement	References
January 2000	Large ( $\geq 10,000$ population ) surface water and GWUDI (Subpart H) systems may begin monitoring to determine Step 1 TOC removals before the compliance date.	K.A.R. 28-15a-132 40 CFR 141.132 (d)(1) KDHE Survival Guide Sect. 4 EPA Enhanced Coagulation Man.
January 1, 2002	Large Subpart H CWSs and NTNCWSs must comply with the MCLs for TTHMs, HAA5s, bromate, and chlorite	K.A.R. 28-15a-64 40 CFR 141.64(b)(1) KDHE Survival Guide Sect. 3

## 1. C. Timetable for the Stage 1 DDBP Rule (con't)

Date	Rule Requirement	References
January 1, 2002	Large Subpart H CWSs and NTNCWSs must comply with the MRDLs for chlorine, chloramines, and chlorine dioxide	K.A.R. 28-15a-65 40 CFR 141.65(b)(1) KDHE Survival Guide Sect. 2
January 1, 2002	Requirements of Subpart L (the Stage 1 DDBP rule) generally apply to large Subpart H CWSs and NTNCWSs regarding 1) monitoring requirements; 2) reporting and recordkeeping requirements; 3) compliance; 4) treatment technique for control of DBP precursors	K.A.R. 28-15a-130 40 CFR 141.130(b)(1) KDHE Survival Guide Sect. 2-4
January 1, 2002	Small Subpart H systems using conventional filtration may begin monitoring to determine Step 1 TOC removals before the compliance date.	K.A.R. 28-15a-132 40 CFR 141.132(d)(1) EPA Enhanced Coagulation Man.
January 1, 2004	Small Subpart H and all groundwater CWSs and NTNCWSs must comply with the MCLs for TTHMs, HAA5s, bromate, and chlorate	K.A.R. 28-15a-65 40 CFR 141.65(b)(2) KDHE Survival Guide Sect. 3
January 1, 2004	Small Subpart H and all groundwater CWSs and NTNCWSs must comply with the MRDLs for chlorine, chloramines, and chlorine dioxide	K.A.R. 28-15a-65 40 CFR 141.65(b)(1) KDHE Survival Guide Sect. 2
January 1, 2004	Small Subpart H and groundwater TNCWSs that use chlorine dioxide must comply with the MRDL for chlorine dioxide	K.A.R. 28-15a-65 40 CFR 141.65(b)(2) KDHE Survival Guide Sect. 2
January 1, 2004	Requirements of Subpart L (the Stage 1 DDBP rule) generally apply to small surface water and GWUDI and groundwater CWSs and NTNCWSs regarding 1) monitoring requirements; 2) reporting and recordkeeping requirements; 3) compliance; 4) treatment technique for control of DBP precursors	K.A.R. 28-15a-130 40 CFR 141.130(b)(1) KDHE Survival Guide Sect. 2-4
January 1, 2004	Small Subpart H TNCWSs that use chlorine dioxide must comply with the requirements for chlorine dioxide and chlorite	K.A.R. 28-15a-130 40 CFR 141.130(b)(2) KDHE Survival Guide Sect. 3
June 30, 2005	Systems that made a clear and irrevocable financial commitment before the applicable compliance date to install technologies that limit TTHMs and HAA5s to 0.040 mg/l and 0.030 mg/l, respectively, must have these technologies installed and operating	K.A.R. 28-15a-135 40 CFR 141.135(a)(2)(iii) KDHE Survival Guide Sect. 4 EPA Enhanced Coagulation Man.

## 2. Monitoring / Compliance Requirements – MRDLs

### 2. A. Introduction

The Stage 1 DDBP Rule is a product of an extended regulatory negotiation process involving water industry representatives, scientists, regulators and other interested parties. The goal of the negotiation was to arrive at a regulation that would reduce exposure of the general public to DBP's, which are associated with cancer risk, while maintaining the well established public health benefits that derive from practicing disinfection to control microbial pathogens. Surface water sources contain dissolved organic matter and are much more susceptible to DBP formation than are ground water sources in general. Even ground water systems must be aware of DBP's, however, because these compounds can form in portions of the water storage and distribution network when conditions are favorable. These conditions include warm temperatures, the presence of organic sediments in pipes or reservoirs, and the concentration of disinfectant routinely maintained as a residual in the distribution system.



The Stage 1 DDBP Rule seeks to minimize DBP's in three ways:

- 1) by optimizing existing treatment processes to remove DBP precursors.
- 2) by controlling disinfectant residual levels to minimize DBP formation following treatment.
- 3) by establishing BATs (best available technologies) for DBP removal if the first two strategies are insufficient to ensure compliance with MCL's.

## **2. B. Maximum Residual Disinfectant Levels (MRDLs)**

The MRDL's apply to all community and non-transient non-community water systems that practice disinfection. In addition, transient systems using chlorine dioxide must comply with the MRDL for that disinfectant.

(Note: KDHE has chosen to not adopt the Maximum Residual Disinfectant Level Goals (MRDLGs) which have been recommended by EPA. References to MRDLGs in federal rules and regulations and EPA guidance manuals do not apply to the drinking water regulations adopted by KDHE and are not applicable to Kansas water supply systems. The rationale used in establishing these values is discussed in detail in the preamble to the Stage 1 DDBP Rule. From a regulatory perspective, the numbers that are important are the MRDLs.)

<b>Disinfectant Residual</b>	<b>MRDL mg/L</b>	<b>(MRDLG) mg/L</b>
Chlorine (as free Cl <sub>2</sub> )	4.0	(4.0)
Chloramines (as total Cl <sub>2</sub> )	4.0	(4.0)
Chlorine dioxide (as ClO <sub>2</sub> )	0.8	(0.8)

**EXCEPTION:** Operators of systems using chlorine or chloramines may increase the concentration of disinfectants to a level, and for a time necessary, to address specific microbiological contamination events such as distribution line breaks, storm run-off events, source water contamination, or cross-connections.

## **2. C. Requirements for Systems Using Chlorine and / or Chloramines**

**Monitoring and Analytical Requirements:** Systems must monitor the disinfectant residual at the same points in the distribution system and at the same time as coliform samples are taken. There are no provisions for reduced monitoring. Residuals must be measured at each sample site using one of the analytical methods prescribed in 40 CFR 141.131(c)(1) (see Section 6). KDHE allows the use of DPD colorimetric kits for measuring disinfectant residuals. Persons who conduct these measurements must receive training in the use of the analytical method chosen by the water system. Section 5.E. of this survival guide contains further discussion of the qualifications required of persons who measure disinfectant residuals.

**Compliance with the MRDLs:** Disinfectant residual measurements taken during each monitoring period are added together and averaged. An average for each calendar quarter is determined. If the average of four quarterly averages exceeds the MRDL, the water system is in violation and must provide public notification. Compliance will not be determined until one full year of sampling has been completed. Thereafter, compliance will be based on the running average computed quarterly. An example of compliance calculations is given in the box below. The best available technology for achieving compliance with the MRDL requirement is to properly manage and control the disinfection process and the disinfectant residual concentration in the distribution system.

**Example:** System collects five coliform samples per month. Disinfectant residual is measured and recorded during each coliform sampling event.

*Results:*    2 mg/L      2 mg/L      4 mg/L      Add the residuals together and divide by five to yield a  
                 5 mg/L      2 mg/L                                   average for the month of 3 mg/L

**At the end of each calendar quarter, the monthly averages are added together and divided by three to yield a quarterly average.**

**At the end of the first year of monitoring, the four quarterly averages, are added together and divided by four to yield an “annual average of quarterly averages”.** Note: A mathematical comparison will show that, for systems that sample monthly, the average of twelve monthly averages is equivalent to the “average of quarterly averages” and either computation may be used to determine compliance.

**If the annual average is > 4 mg/L for chlorine and chloramines, the water system has exceeded the MRDL and must report to the state and provide public notification. If the average is < MRDL, the system is in compliance.**

**Reporting and Recordkeeping:** The water system must keep a record of disinfectant residual measurements for each coliform sample taken, and from these measurements calculate monthly and quarterly averages (as discussed in the previous section). These records should be retained for the same time period as the system retains coliform sample results. Within ten days of the end of each quarter, the system must report the following information to KDHE:

1. The number of samples taken during each month of the previous quarter.
2. The monthly arithmetic average of all samples taken in each month for the past twelve months.
3. The arithmetic average of all quarterly averages for the past 12 months (or the average of the preceding twelve monthly averages for systems sampling monthly).
4. Based on the calculation in No. 3 above, state whether or not the MRDL was exceeded.

**Public Notification:** Exceeding the MRDL for chlorine or chloramines is a violation which requires the public to be notified in accordance with the requirements for non-acute health risks. These requirements are spelled out in the public notification rule but not repeated here. Systems may seek assistance from DEQ if they are unclear about notification requirements.

**It is important to keep in mind that the purpose of routine residual measurements is to assist the water system operator in optimizing the disinfection process. The MRDL is based on a running annual average, so there is plenty of time to correct an upward drift in residual concentration. An MRDL violation should be easy to avoid.**

## **2. D. Requirements for Systems Using Chlorine Dioxide**

**Monitoring and Analytical Requirements:** The system must sample chlorine dioxide residual daily at the entrance to the distribution system using a DPD or amperometric method (see Section 6). If any daily sample exceeds the MRDL, the system must conduct three additional samplings the following day, as follows:

1. If chlorine dioxide or chloramines are used to maintain a disinfectant residual in the distribution system, or if chlorine is used to maintain a distribution system residual and there are no disinfection addition points after the entrance to the distribution system (no “booster” chlorination), then the system must take three chlorine dioxide samples as close to the first customer as possible and at intervals of at least six hours.
2. If chlorine is used for the distribution system residual and there are one or more disinfection addition points after the entrance to the distribution system, then the system must take one sample as close to the first customer as possible, one sample at a location representative of average distribution system residence time, and one sample as close to the end of the distribution system as possible (reflecting maximum residence time).

**Compliance with the MRDL:** Compliance is based on the sampling procedures described above. There are both acute and non-acute violations:

1. If any daily sample exceeds the MRDL, and on the following day one or more of the three samples taken in the distribution system exceed the MRDL, the system is in violation of the MRDL and must take immediate corrective action to lower the level of chlorine dioxide below the MRDL. Failure to take samples in the distribution system the day following an exceedance of the MRDL at the entrance to the distribution system will also be considered an MRDL violation. An MRDL violation of either type requires that the public be notified in accordance with the requirements for acute health risks (see additional information below).
2. If any two consecutive daily samples taken at the entrance to the distribution system exceed the MRDL and all distribution system samples taken are below the MRDL, the system is in violation of the MRDL and must take corrective action to lower the level of chlorine dioxide below the MRDL at the point of sampling. Failure to monitor at the entrance to the distribution system the day following an exceedance of

the chlorine dioxide MRDL at the entrance to the distribution system is also an MRDL violation. An MRDL violation of either type requires that the public be notified in accordance with the requirements for non-acute health risks (see below).

**Reporting and Record-Keeping:** Within ten days following the end of each quarter, the system must report the following information to KDHE:

1. The dates, results, and locations of samples taken during the last quarter.
2. Whether the MRDL was exceeded.
3. Whether the MRDL was exceeded in any two consecutive daily samples and whether the resulting violation was acute or non-acute.

**Public Notification:** The public notification requirements for acute and non-acute violations are described in the public notification rule and are not repeated here. These requirements vary with system size and type. If water systems have not experienced violations requiring public notification in the past, they may seek assistance from DEQ.

### 3. Monitoring / Compliance Requirements - DBPs

#### 3. A. Introduction

The Stage 1 DDBP Rule requires water systems to monitor for DBPs at a frequency that is based on system size and type. All systems must monitor for **total trihalomethanes (TTHMs)** and a group of **five haloacetic acids (HAA5s)**. In addition, systems using chlorine dioxide must monitor for chlorite, and systems using ozone must monitor for bromate. This section describes MCLs for disinfection by-products and outlines the various monitoring schemes.

#### 3. B. MCLs for Disinfection Byproducts

TTHM is the sum of the concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform. HAA5 is the sum of the concentrations of mono-, di-, and tri-chloroacetic acids and mono- and dibromoacetic acids.

Disinfection By-Products	MCL mg/L	(MCLG) mg/L
<b>Total Trihalomethanes</b>	<b>0.080</b>	----
Chloroform		(Zero)
Dibromodichloromethane		(Zero)
Dibromochloromethane		(0.06)
Bromoform		(Zero)

### MCLs for Disinfection Byproducts (con't)

Disinfection By-Products	MCL mg/L	(MCLG) mg/L
<b>5 Haloacetic Acids</b>	<b>0.060</b>	-----
Dichloroacetic Acid		(Zero)
Trichloroacetic Acid		(0.3)
<b>Chlorite</b>	<b>1.0</b>	(0.8)
<b>Bromate</b>	<b>0.010</b>	(Zero)

(Note: KDHE has chosen to not adopt the Maximum Contaminant Level Goals (MCLGs) which have been recommended by EPA. References to MCLGs in federal rules and regulations and EPA guidance manuals do not apply to the drinking water regulations adopted by KDHE and are not applicable to Kansas water supply systems. There are no MCLGs for the sum of TTHMs and HAA5s. The rationale used in establishing these values is discussed in detail in the preamble to the Stage 1 DDBP Rule. From a regulatory perspective, the numbers that are important are the MCLs.)

### 3. C. Monitoring Requirements for TTHMs and HAA5s

**General Requirements:** Systems must take all samples during normal operating conditions. Multiple wells drawing from a single aquifer may be considered one “treatment plant” when determining the minimum number of TTHM and HAA5 samples required. KDHE’s criteria to determine conformance to this reduced sampling plan is in 5.G. of this survival guide.

**Monitoring Plans:** Each system subject to the Stage 1 DDBP Rule must develop a monitoring plan. The system is required to maintain the plan and make it available for inspection by KDHE and the general public no later than 30 days following the applicable compliance dates (see table at 1. C. on page 6 of this survival guide for compliance dates). Subpart H systems that serve more than 3,300 people must submit a copy of the monitoring plan to KDHE at the time it submits its first report of monitoring results (see reporting requirements on page 16). KDHE may require any water system to submit a copy of its monitoring plan. After review, KDHE may require changes in any plan elements. The plan must include:

1. Specific locations and schedules for collecting samples for any parameters required by the Stage 1 DDBP Rule. The system’s coliform monitoring plan will suffice to demonstrate the sampling scheme for disinfectant residuals.
2. A description of how the system will calculate compliance with MCLs, MRDLs, and treatment techniques.
4. The plan must be representative of the entire distribution system, including any consecutive water systems.

Developing a monitoring plan for systems having multiple treatment plants (a treatment plant is any point in the system where treatment is applied) and multiple sources may be a complex undertaking. It will require the system to 1) acquire a detailed knowledge of its distribution network; and 2) understand the proportional contributions made by different sources and treatment zones, and any seasonal variations that may occur in these conditions.

**Routine Monitoring Requirements:** The following table summarizes routine monitoring requirements by system size and type. Subpart H Systems serving 10,000 or more persons are to begin monitoring for TTHMs and HAA5s in the first quarter of 2002. All other systems will initiate this monitoring in the first quarter of 2004.

<b>Size and Type of System</b>	<b>Minimum Monitoring Frequency</b>	<b>Sample Location in the Distribution System</b>
Subpart H system serving at least 10,000 persons.	Four water samples per quarter per treatment plant.	At least 25 percent of all samples collected each quarter at locations representing maximum residence time. Remaining samples taken at locations representative of at least average residence time in the distribution system and representing the entire distribution system, taking into account the number of persons served, different sources of water, and different treatment methods.
Subpart H system serving from 500 to 9,999 persons	One water sample per quarter per treatment plant	Locations representing maximum distribution system residence time.
Subpart H system serving fewer than 500 persons	One water sample per year per treatment plant during month of warmest water temperature	Locations representing maximum residence time. If the sample (or average of annual samples if more than one is taken) exceeds the MCL, system must increase monitoring to one sample per treatment plant per quarter, taken at a point reflecting the maximum residence time in the distribution system, until system is able to meet the requirements for reduced monitoring
System using <b>only ground water</b> , using chemical disinfectant, and serving at least 10,000 persons	One water sample per quarter per treatment plant.	Locations representing maximum distribution system residence time.
System using <b>only ground water</b> , using chemical disinfectant, and serving fewer than 10,000 persons	One sample per year per treatment plant during month of warmest water temperature.	Locations representing maximum residence time. If the sample (or average of annual samples if more than one is taken) exceeds the MCL, system must increase monitoring to one sample per treatment plant per quarter, taken at a point reflecting the maximum residence time in the distribution system, until system is able to meet the requirements for reduced monitoring.

**Reduced Monitoring for TTHMs and HAA5s:** The following table describes the conditions that must be met in order to qualify for reduced monitoring. With the exception of large systems that monitored under the Information Collection Rule, no system may qualify for reduced monitoring until it has monitored at routine levels (preceding table) for at least one year. **There are no provisions for reduced monitoring for Subpart H systems serving fewer than 500 persons, because routine monitoring for these systems is at the minimum frequency allowed for surface water systems under this rule.** Water systems must return to routine monitoring if the annual average exceeds 0.060 mg/L for TTHMs and 0.045 mg/L for HAA5s, or at KDHE's request.

Size and Type of System	System may reduce monitoring if it has monitored at least one year and has. . .	Reduced Monitoring Frequency
Subpart H system serving at least 10,000 persons which has a source water annual average TOC level before any treatment $\leq 4.0$ mg/L.	TTHM annual average $\leq 0.040$ mg/L and HAA5 annual average $\leq 0.030$ mg/L	One sample per treatment plant per quarter at distribution system location reflecting maximum residence time.
Subpart H system serving from 500 to 9,999 persons which has a source water annual average TOC level before any treatment $\leq 4.0$ mg/L.	TTHM annual average $\leq 0.040$ mg/L and HAA5 annual average $\leq 0.030$ mg/L.	One sample per treatment plant per year at distribution system location reflecting maximum residence time during month of warmest water temperature.
System using <b>only ground water</b> , using chemical disinfectant, and serving at least 10,000 persons	TTHM annual average $\leq 0.040$ mg/L and HAA5 annual average $\leq 0.030$ mg/L.	One sample per treatment plant per year at distribution system location reflecting maximum residence time during month of warmest water temperature.
System using <b>only ground water</b> , using chemical disinfectant, and serving fewer than 10,000 persons	TTHM annual average $\leq 0.040$ mg/L and HAA5 annual average $\leq 0.030$ mg/L for two consecutive years OR TTHM annual average $\leq 0.020$ mg/L and HAA5 annual average $\leq 0.015$ mg/L for one year.	One sample per treatment plant per three year monitoring cycle at distribution system location reflecting maximum residence time during month of warmest water temperature, with the three year cycle beginning on January 1 following quarter in which system qualifies for reduced monitoring.

### 3. D. Monitoring for Chlorite

Systems that use chlorine dioxide as a disinfectant must monitor for chlorite. This includes transient water systems. Routine monitoring at the entrance to the distribution is required daily. Monitoring at the entrance to the distribution system may not be reduced. In addition, a three-sample set of chlorite samples must be taken each month at various locations in the distribution system. Distribution system monitoring may be reduced to once per quarter after

one full year of monthly monitoring if there are no individual samples above the MCL and there has been no sample at the entrance to the system that exceeded the MCL. If daily monitoring at the entrance to the distribution system results in an exceedance of the chlorite MCL, the system is required to take a three-sample set on the day following the MCL exceedance. These requirements are summarized in the following table.

<b>Type of Sampling</b>	<b># Required</b>	<b>Location</b>
Routine	One Sample Daily	Entrance to the Distribution System
Monthly	Three-sample set once per month.	In the distribution system: 1. Near the first customer; 2. At a location representing average residence time; and 3. At a location reflecting maximum residence time in the distribution system.
Additional	Three-sample set on the day following an MCL exceedance during routine monitoring.	In the distribution system at locations specified above for monthly monitoring. If a system is required to collect a three-sample set as a result of an MCL exceedance at the entrance to the distribution system, these samples may be used to meet the monthly monitoring requirements.
Reduced	<b>Distribution system monitoring only</b> —one three sample set per quarter.	Allowed only if, during the past year of monitoring, there have been no individual samples in excess of the MCL and no samples at the entrance to the distribution have exceeded the MCL. Sampling reverts to monthly if any individual distribution system sample or any sample at the entrance to the distribution system exceeds the MCL.

### 3. E. Monitoring for Bromate

Community and nontransient noncommunity systems that use ozone disinfection must monitor for bromate once per month for each treatment plant that uses ozone disinfection. The monthly sample is to be taken at the entrance to the distribution system while the ozonation system is operating under normal conditions.

The system may qualify for a reduction to quarterly bromate monitoring if it collects representative measurements of bromide in the source water each month and the average of these samples is less than 0.05 mg/L. Anytime the running annual average of source water bromide equals or exceeds 0.05 mg/L, the system must return to monthly bromate monitoring.

### 3. F. Compliance Requirements

**TTHMs and HAA5s:** Compliance is based on a running annual arithmetic average which is computed quarterly. If the running average of any consecutive four-quarter period exceeds the MCL, the system is in violation - it must notify the public and report to KDHE. If a system fails to complete four quarters of monitoring, compliance will be based on an average of the available data. Systems monitoring less often than quarterly will base compliance on an average of samples taken during the year. If this average exceeds the MCL, monitoring must be increased to once per quarter per plant.



Systems on reduced monitoring must revert to routine monitoring if the TTHM annual average exceeds 0.060 mg/L or the HAA5 annual average exceeds 0.045 mg/L. Water systems will not be considered in violation of the MCL until they have completed one year of quarterly monitoring.

**Chlorite:** Compliance is based on the arithmetic average of each three-sample set. If this average exceeds 1.0 mg/L, the system is in violation - it must notify the public and report to KDHE.

**Bromate:** Compliance is based on a running annual arithmetic average which is computed quarterly. If the average bromate concentration of samples collected in any consecutive four-quarter period exceeds the MCL, the system is in violation - it must notify the public and report to KDHE. If the system fails to complete 12 consecutive months of monitoring, MCL compliance is based on the average of available data.

### 3. G. DBP Reporting Requirements

Systems monitoring quarterly or more frequently must report within ten days of the end of each calendar quarter. Systems sampling less frequently than quarterly must report within ten days of the end of each monitoring period. The following table summarizes the reporting requirements.

System Monitoring for . . .	Must Report. . .
TTHM and HAA5 on quarterly or more frequent basis.	<ol style="list-style-type: none"> <li>1. Number of samples taken during the last quarter.</li> <li>2. Location, date, and result of each sample.</li> <li>3. The arithmetic average of all samples during the last quarter.</li> <li>4. Arithmetic average of the quarterly arithmetic averages for the last four quarters.</li> <li>5. Whether the MCL was exceeded.</li> </ol>
TTHM and HAA5 less than quarterly but at least annually.	<ol style="list-style-type: none"> <li>1. Number of samples taken during the last year.</li> <li>2. Location, date, and result of each sample taken during the last quarter.</li> <li>3. The arithmetic average of all samples taken over the last year.</li> <li>4. Whether the MCL was exceeded.</li> </ol>
TTHM and HAA5 less frequently than annually.	<ol style="list-style-type: none"> <li>1. The location, date, and result of the last sample taken.</li> <li>2. Whether the MCL was exceeded.</li> </ol>
Chlorite	<ol style="list-style-type: none"> <li>1. Number of samples taken each month for the last 3 months.</li> <li>2. Location, date, and result of each sample taken during the last quarter.</li> <li>3. For each month in the reporting period, the arithmetic average of all samples taken in the month.</li> <li>4. Whether the MCL was exceeded, and in which month it was exceeded.</li> </ol>
Bromate	<ol style="list-style-type: none"> <li>1. Number of samples taken in the last quarter.</li> <li>2. The location, date, and result of each sample taken during the last quarter.</li> <li>3. The arithmetic average of the monthly arithmetic averages of all samples taken in the last year.</li> <li>4. Whether the MCL was exceeded.</li> </ol>

**KDHE has specific forms available for system use in completing and reporting these monitoring requirements which are available in section 6 of this survival guide.**

## 4. Monitoring / Treatment Technique Requirements – DBP Precursors

### 4. A. Introduction

The Stage 1 DDBP Rule imposes special requirements on surface water systems that practice conventional filtration. These requirements are based on the knowledge that surface water contains dissolved substances that contribute to the formation of DBPs, and that optimized conventional treatment is capable of significantly reducing the amount of precursors in the treated water. For the purposes of this discussion, a conventional filtration process is one that includes the addition of coagulant to the raw water followed by a sedimentation step during which the coagulant floc can be removed prior to passing the water through filters.

### 4. B. Monitoring Requirements

**Total Organic Carbon (TOC) Monitoring:** Subpart H systems that practice conventional filtration must monitor each treatment plant for TOC no later than the point of combined filter effluent turbidity monitoring and at a location that is representative of the treated water. The system must also monitor for TOC in the source water prior to any treatment, at the same time as monitoring for TOC in the treated water. These source water and treated water samples are referred to as paired samples. At the same time as the source water TOC sample is taken, the system must monitor for alkalinity in the source water prior to any treatment. Systems must take one set of paired samples and one source water alkalinity sample per month per treatment plant at a time representative of normal operating conditions and influent water quality.

**Monitoring Plan Required:** Systems monitoring for TOC and alkalinity must prepare a monitoring plan and make it available for inspection by KDHE and the general public. Systems serving more than 3300 customers must submit their plan to KDHE; KDHE may require changes to the monitoring plan. The plan must contain specific locations and schedules for collecting samples for TOC and alkalinity. The TOC monitoring plan may be integrated with the system's monitoring plan for DBPs and disinfectant residuals.

**Reduced Monitoring:** Systems with an average treated water TOC of less than 2.0 mg/L for two consecutive years, or less than 1.0 mg/L for one year, may reduce monitoring for both TOC and alkalinity to one source water alkalinity sample per plant per quarter. The system must revert to routine monitoring in the month following the quarter when the annual average treated water TOC  $\geq$  2.0 mg/L.

### 4. C. Treatment Technique Requirements

**Alternative Compliance Criteria:** Systems using conventional filtration must practice enhanced coagulation or enhanced softening to remove a certain percentage of raw water TOC unless the system can meet at least one of the following alternative compliance criteria:

1. The system source water TOC level is less than 2.0 mg/L, calculated quarterly as a running annual average.

2. The system's treated water TOC level is less than 2.0 mg/L, calculated quarterly as a running annual average.
3. The system's source water TOC level is less than 4.0 mg/L, calculated quarterly as a annual running average; the source water alkalinity is greater than 60 mg/L (as CaCO<sub>3</sub>), calculated quarterly as an annual running average, and either the TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively; or, prior to the compliance date for this rule the system has made a clear and irrevocable financial commitment to use technologies to limit TTHM and HAA5 to no more than these levels. **This technology must be installed by June 16, 2005.**
4. The TTHM and HAA5 running annual averages are no greater than 0.040 mg/L and 0.030 mg/L, respectively, and the system uses only chlorine for primary disinfection and maintenance of a disinfection residual in the distribution system.
5. The system's source water SUVA (as defined by KDHE) prior to any treatment and measured monthly, is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.
6. The system's finished water SUVA, measured monthly, is less than or equal to 2.0 L/mg-m, calculated quarterly as a running annual average.

**Systems that practice enhanced softening which are unable to meet at least one of the criteria above, may use one of the alternative criteria listed below:**

1. Softening which results in lowering the treated water alkalinity to less than 60 mg/L (expressed as calcium carbonate), measured monthly and calculated quarterly as an annual running average.
2. Softening which results in removing at least 10 mg/L of magnesium hardness (expressed as calcium carbonate), measured monthly and calculated quarterly as a running annual average.
3. **Step 1 TOC Removal Requirements:** Systems which cannot meet any of the preceding criteria must practice enhanced coagulation or softening to achieve the percent TOC removals shown in the following table. Systems practicing softening are required to meet the TOC reductions shown in the far right column of the table (Source water alkalinity > 120 mg/L). All alkalinities are expressed as CaCO<sub>3</sub>.

Source Water TOC in mg/L	Source Water Alkalinity 0-60 mg/L	Source Water Alkalinity > 60-120 mg/L	Source Water Alkalinity >120 mg/L
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

As an example, a system that has a raw water TOC level of 5.5 mg/L and a source water alkalinity of 72 mg/L must remove 35% of the TOC if it practices enhanced coagulation.

A system with the same TOC and alkalinity that practices softening must remove 25% of the TOC.

**Step 2 TOC Removal Requirements:** Systems that are unable to meet the removal requirements in the preceding table (or the alternative compliance criteria listed previously) must apply to KDHE, within three months of failing to meet the removal requirements, for approval of alternative minimum TOC removal standards. This process is complex and is not discussed in this survival guide. The water system and KDHE will work together to establish alternative TOC requirements in accordance with the procedures specified in 40 CFR 141.131(b)(3) and/or (4) and described in EPA's Enhanced Coagulation Manual. See also the discussion under Section 5.H. of this survival guide.

#### **4. D. Compliance Calculations**

Compliance is determined by dividing actual TOC removal by required TOC removal for each month. The results for twelve months are averaged. If the result is < 1.00, the system is not in compliance with the TOC removal requirements. A water system may assign a value of 1.0 in any month that:

- The system's treated or source water TOC concentration is < 2.0 mg/L;
- The system's softening process removes at least 10 mg/L of magnesium hardness;
- The system's source water SUVA before treatment is 2.0 L/mg-m, **or** the system's finished water SUVA is 2.0 L/mg-m, **or** a system practicing enhanced softening lowers alkalinity below 60 mg/L.

### **5. KDHE Recordkeeping / Special Primacy Requirements**

#### **5. A. Introduction**

This section describes the policies and procedures that KDHE will follow in order to meet the recordkeeping and special primacy requirements of the Stage 1 DDBP Rule.

#### **5. B. Recordkeeping by the State**

KDHE will keep the following records in connection with Stage 1 DDBP Rule activities. Most of these records will be maintained in the water system master file located at each District office.

1. Any determinations made by KDHE, including supporting information and an explanation of the technical basis for each decision. These records must also include any interim measures allowed by KDHE.

- a. Records of any systems that elect to install granular activated carbon or membrane filtration processes as a means of complying with the rule. These records must include the date by which the system is required to have these processes installed.
  - b. Records of systems that are required to meet alternative minimum TOC removal requirements or for whom KDHE has determined that the source water is not amenable to enhanced coagulation. These records must include alternative limits and rationale for establishing the alternative limits.
  - c. Records of Subpart H systems using conventional treatment meeting any of the alternative compliance criteria in 40 CFR 141.135(a)(2) and (3), as described in Section 4 of this survival guide.
  - d. A register of qualified operators that have met KDHE requirements.
2. Records of systems with multiple wells considered to be one treatment plant, including the technical basis and rationale for this conclusion.
  3. Monitoring plans for Subpart H systems serving more than 3,300 customers.
  4. A list of laboratories approved to perform analyses required under the Stage 1 DDBP Rule. This list is published and periodically updated by the KDHE, Division of Laboratories, which is the certifying authority for drinking water labs in the state.
  5. KDHE will maintain a list of all systems that practice disinfection and must monitor for disinfectants and disinfection byproducts under this rule. This list will include all disinfectants and DBPs, other than chlorine, TTHMs, and HAA5s, if any, that are measured.

## **5. C. Interim Treatment Requirements**

The Stage 1 DDBP Rule allows large systems (more than 10,000 population) that elect to comply by installing granular activated carbon or membrane filtration treatment to apply for a two-year extension of the compliance deadline. In these situations, KDHE must determine any interim treatment requirements that the system will be required to meet in order to minimize customer risk until treatment is in place.

## **5. D. Qualification of Operators**

The State of Kansas has a mandatory operator certification program. All community and non-transient non-community water systems are required to have a certified operator. Regulations to that effect (K.A.R. 28-16-30 to 36) are designed around criteria established by EPA Guidance, and ensure that all operators are certified at a level appropriate for the size and type of system they are operating. KDHE administers testing and certification activities and maintains a registry of certified operators for the State.

These Kansas regulations ensure that transient systems are also operated by persons who possess qualifications commensurate with the size and complexity of the water system. In

addition to these requirements, Section 5.E. of this survival guide describes qualifications needed by operators who will be conducting on site measurements of disinfectant residuals.

### **5. E. Qualifications of Persons Performing Measurements**

The Stage 1 DDBP Rule requires on site measurements of disinfectant residuals and, in some cases, pH, bromide, and alkalinity. KDHE requires that these measurements be taken by the system operator or another person acting under his or her direct supervision. The qualifications required of system operators (as discussed in Section 5.D.) ensures that sufficient knowledge exists to conduct these measurements in an accurate and repeatable fashion. Persons performing the on site measurements must have training in the use of each piece of equipment used in the testing process. All testing equipment must be properly calibrated in accordance with the manufacturer's instructions.

### **5. F. Use of DPD Colorimetric Kits**

KDHE allows DPD colorimetric kits to be used for measuring chlorine and chloramine residuals, but strongly discourages their use for measuring chlorine dioxide residuals. Because the DPD method for measuring chlorine dioxide residuals is highly susceptible to error in the presence of interferences such as manganese and chlorine, KDHE strongly recommends the amperometric titration method over the DPD method in general and for CT calculations and POE compliance monitoring in particular.

### **5. G. Demonstrating that Multiple Wells are Drawn from a Single Aquifer**

As noted in Section 3. C., systems which have multiple wells that draw water from a common aquifer may use reduce the number of samples that must be taken when monitoring for disinfection byproducts. Based on an evaluation of geologic and hydrologic characteristics, KDHE has categorized groundwater sources that demonstrate the finished water quality characteristics of all the wells drawing from the identified aquifer are very similar, such that the water from these wells would be expected to react alike in terms of formation of DBPs. KDHE will also consider the classification or re-classification of any systems based on additional information submitted by a qualified hydrogeologist, geologist, or engineer. Additional resources to be considered may consist of the following information:

1. Well construction and geology.
2. Well locations, marked on a topographical map.
3. Well depths.
4. Well logs which show geological strata, identify water production zones, screened or slotted areas, and grouting of the annular space.
5. Static water levels.
6. Aquifer studies and maps.
7. Treatment applied.
8. Water characteristics and chemistry of each well.
9. Field temperature and field pH of each well.
10. Specific conductivity.
11. Total organic carbon.
12. Analyses of common ions with a calculated cation / ion balance (calcium, magnesium, iron, manganese, sodium sulfate, alkalinity, and chloride).

The key factor in this demonstration is the similarity of waters with respect to DBP formation potential. A variety of statistical treatments may be used to group waters together according to chemical characteristics. Source waters that are not necessarily drawn from the same water bearing formation may nonetheless be similar enough in their chemistry to be treated together in DBP sampling. A water system may choose to sample source waters for total organic carbon, which is a relatively inexpensive test that can be combined with other lines of evidence to demonstrate similar DBP formation potential in different wells.

KDHE may require modification of a monitoring plan that is based on a “common aquifer” demonstration if results of early sampling reveal levels of DBP occurrence that are independent of source water characteristics. This may be particularly likely in ground water systems, where factors such as ground water intrusion, corrosion of buried pipes, sediment accumulation, and biofilm growth can alter water chemistry in the distribution system and lead to DBP formation that is not entirely dependent on source water chemistry.

## 5. H. Alternative TOC Removal Requirements

Based on current experience and knowledge, KDHE considers it unlikely that any of the conventional treatment facilities in Kansas will have difficulty achieving the alternative compliance criteria or the TOC removal requirements. However, if it proves impossible for a system to meet these requirements, KDHE intends to closely follow the suggestions offered in Section 2.3.2 of EPA’s Enhanced Coagulation Manual. All determinations will be made on a case-by-case basis and will require bench or pilot scale testing by the water system that is designed to demonstrate the best level of TOC removal feasibly attainable, given the unique characteristics of the raw water which must be treated.

## 6. Forms, Calculations, & Approved Measurement Methods

### 6. A. EPA Approved Methods for Disinfectant Residual Monitoring

The following table lists the methods approved by EPA for use in disinfectant residuals monitoring.

Methodology	Standard Method	ASTM Method	Free Chlorine	Combined Chlorine	Total Chlorine	Chlorine Dioxide
Amperometric Titration	4500-CI D	D 1253-86	X	X	X	
Low Level Amperometric Titration	4500-CI E				X	
DPD Ferrous Titrimetric	4500-CI F		X	X	X	
DPD Colorimetric	4500-CI G		X	X	X	
Syngaldazin e (FACTS)	4500-CI H		X			
Iodometric Electrode	4500 CI I				X	
DPD	4500-CIO <sub>2</sub> D					X*
Amperometric Method II	4500-CIO <sub>2</sub> E					X

\*Credible results may not be obtained even with suppression of interferences outlined in method

## 6. B. Reporting Instructions

These instructions are to assist you in completing quarterly monitoring reports. Quarterly reports are due no later than the 10<sup>th</sup> day of the month following a monitoring period. **Therefore, these reports are due no later than April 10, 2004 (1<sup>st</sup> Quarter 2004); July 10, 2004 (2<sup>nd</sup> Quarter 2004); October 10, 2004 (3<sup>rd</sup> Quarter 2004); and January 10, 2005 (4<sup>th</sup> Quarter 2004), etc....**

Please use these forms unless you have something comparable. **The forms should be accompanied by a signed and dated cover letter.** Submission electronically is permissible so long as you send hard copies later. The receipt of an electronic version will satisfy the reporting deadline.

The Stage 1 DDBP Rule holds water systems responsible for compliance - not KDHE. KDHE has limited resources. Compliance with this and other rules requires a proactive approach by systems. This includes taking steps to deal with problems that might arise like broken sample bottles, delayed reporting of lab results, etc. If KDHE has not sent you the results for some parameter call them. Often the test was run but the slip wasn't yet mailed.

EPA will assign violations after consultation with KDHE until KDHE achieves primacy for this rule. Systems will be required to notify the public of violations as required in the federal rules. KDHE will assist systems in understanding the Public Notification Rule (PN) requirements.

## 6. C. Completing Forms

**General:** Provide your water system's account number which is typically a five (5) character identification with a letter followed by a series of four (4) numbers (H0304 for example). Also provide the name of your water system and the name or number of the plant for which this monitoring has been completed. The plant name may be the same as a well number or point of entry (POE) number.

When plants are off-line for an entire month or quarter or a sample is missed, etc. indicate that on the form for that period and put N/A in the column(s) where results are posted. Do not put a zero for any month or quarter a plant is off-line or data is missing. The rule says compliance is based on the available data. Monitoring violations will be assessed for missing or incomplete data.

**MCLs – TTHMs / HAA5s:** Provide the sampling location(s) for which the samples were collected. Monitoring plans should identify which sample was at maximum residence time. KDHE is not responsible for selecting sites for TTHM and HAA5 samples. It is the responsibility of the system to select these sites. Changes in the distribution system may necessitate new sites to accurately reflect maximum residence time. Consultation with KDHE is needed before changing sites.

### **TTHM & HAA5 Sampling Frequency:**

**Surface Water Systems Serving 500 – 9,999 Population** are required to collect one (1) sample per plant per quarter from a site identified as being the maximum residence time (MRT) in the distribution system.



**Surface Water Systems Serving < 500 Population** are required to collect one (1) sample per plant\* during the warmest month of the warmest water temperature. This one sample shall be collected from a site identified as being the maximum residence time (MRT) in the distribution system.

**Ground Water Systems Serving  $\geq$  10,000 Population** are required to collect one (1) sample per plant per quarter from a site identified as being the maximum residence time (MRT) in the distribution system.

**Ground Water Systems Serving < 10,000 Population** are required to collect one (1) sample per plant\* during the warmest month of the warmest water temperature. This one sample shall be collected from a site identified as being the maximum residence time (MRT) in the distribution system.

\* For systems that are only required to collect one sample during the month of warmest water temperature – exceeding the MCL for either TTHM or HAA5 will require increased monitoring on a quarterly basis. One sample per quarter shall be collected from a site identified as being the maximum residence time (MRT) in the distribution system. Compliance is based on a running annual average (RAA) of the data collected during the four (4) most recent quarters.

**Compliance Determination:** In accordance with 40 CFR 141.133(b)(1), for water systems monitoring quarterly (surface water systems serving 500 – 9,999 persons and groundwater systems serving > 10,000 persons) compliance is based on a running annual average computed quarterly, using the averages of all samples collected by the system.

For water systems monitoring less frequently than quarterly (surface water systems serving < 500 persons and groundwater systems serving < 10,000 persons), compliance is demonstrated if the single sample collected in the month of the warmest water temperature at a location representing the maximum residence time is in compliance with the MCL of 80 µg/L for TTHMs and 60 µg/L for HAA5s. If the average of these samples exceeds the MCL, the facility is not immediately out of compliance. The system must increase to quarterly monitoring immediately. Compliance is then based on the running annual average, computed quarterly, using all of the quarterly sample results. (Note: if the sum of fewer than four quarters of data exceeds 320 µg/L for TTHMs or 240 µg/L for HAA5s, then the system is immediately in violation since they will exceed the applicable MCL even if the remaining quarters are zero.)

#### **How to Determine Compliance with the MCLs for TTHM and HAA5 for Systems Monitoring Quarterly:**

1. Determine the running annual average. To determine the running annual average, add the four most recent consecutive quarterly averages together, then divide by four. This is your running annual average.
2. Compare your running annual averages for TTHM and HAA5. If your running annual average for TTHM and HAA5 is less than or equal to 80 µg/L or 60 µg/L respectively, the facility is in compliance with the MCLs.

## Maximum Residual Disinfection Level reporting:

### Maximum Residual Disinfection Levels (MRDLs) for chlorine and/or chloramines:

The residual must be tested when taking coliform samples at sites stipulated in your coliform monitoring plan. Identify the sites you are using for the Stage 1 DDBP Rule MRDL compliance in the required monitoring plan. You are required to report and average of all chlorine residuals collected at the same time of coliform samples every month.

**Sample Locations:** Within the distribution system at the same time and locations where samples for total coliform are collected.

**Compliance Determination:** In accordance with 40 CFR 141.133(c)(1), compliance is based on a running annual arithmetic average computed quarterly, using the monthly averages of all samples collected.

1. Each month, add together the disinfectant residual results of all the samples taken during the month at the total coliform sampling locations. Divide by the total number of total number of samples. This is your monthly MRDL average.
2. Determine the running annual average. To determine the running annual average, add the twelve most recent consecutive monthly MRDL averages together, then divide by twelve. This is your running annual average.
3. Compare your running annual average to the MRDL for chlorine / chloramines of 4.0 mg/L. If your running annual average for the MRDL is less than 4.0 mg/L, the facility is in compliance with the maximum residual disinfectant level.

An example MRDL compliance calculation is provided below. The results are listed in mg/L.

Month	MRDL Monthly Averages	Reporting the MRDL to the Department
January 2004	4.5	<ul style="list-style-type: none"><li>◆ Report your Monthly MRDL results to the Department on a quarterly basis.</li><li>◆ Submit the quarterly RAA within 10 days of the end of each quarter</li><li>◆ For example, January-March 2004 results are due to the Department on April 10, 2004.</li></ul>
February 2004	3.5	
March 2004	3.2	
April 2004	4.6	
May 2004	3.3	
June 2004	2.4	
July 2004	3.4	
August 2004	2.9	
September 2004	2.8	
October 2004	2.7	
November 2004	2.4	
December 2004	3.1	
MRDL Running Annual Average	Add the last 12 monthly averages to calculate the RAA <b>4.5 + 3.5 + 3.2 + 4.6 + 3.3 + 2.4 + 3.4 + 2.9 + 2.8 + 2.7 + 2.4 + 3.1 = 38.8/12 (Most Recent Months) = 3.2 mg/L</b>	

In the example above, the running annual average is 3.2 mg/L. Therefore, the system in the example is in compliance with the MRDL of 4.0 mg/L.

### **Total Organic Carbon**

**TOC Form:** TOC calculations demonstrate if the system is achieving compliance with the precursor removal provisions of the rule.

If you take more than one set of TOC samples in a month, average the results for that month and enter that in the chart. Make sure the monitoring is consistent with the monitoring plan. Send a modified monitoring plan when changes in monitoring are made.

The reporting form notes that there are six alternatives that allow you to report a ratio of 1.0 for a given month. Those are:

1. In any month a system's source water TOC level is less than 2.0 mg/L
2. In any month a system's treated TOC level is less than 2.0 mg/L
3. In any month a system's source water SUVA prior to treatment is  $\leq 2.0$  L/mg-m
4. In any month a system's finished water SUVA is  $\leq 2.0$  L/mg-m
5. In any month a system softening removes at least 10 mg/L of magnesium hardness
6. In any month a system that is practicing enhanced softening lowers alkalinity below 60 mg/L

A column has been added to the form to identify which of the six alternative criteria you think apply in a given month. If you invoke alternatives 5 or 6, provide the appropriate data to support that. Be sure you calculate the actual ratio in case it's  $> 1.0$ .

**Compliance Determination:** In accordance with 40 CFR 141.135(c), compliance is based on a running annual average of removal ratios computed quarterly, using the monthly averages of all removals achieved.

### **How to Determine Compliance with the Treatment Technique for Monthly TOC Removal:**

1. Collect one sample of source water alkalinity, one sample of source water TOC, and one sample of treated water TOC (also known as TOC paired samples) every month. The alkalinity and raw water TOC are used to figure out how much TOC removal is required that month using the chart (3 X 3 Matrix) below:

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L)		
	0 to 60	> 60 to 120	> 120
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

2. Determine the monthly removal ratio. Once you know the required TOC removal percentage for a given month you calculate how much TOC you have removed for that month. One way to calculate the removal is to use this formula:  $(\text{source water TOC} - \text{treated water TOC} \div \text{source water TOC}) \times 100$ . To calculate the monthly removal ratio divide the removal % achieved by the removal % required from the 3 X 3 Matrix above.
3. Determine the running annual average. To determine the running annual average, add the 12 most recent consecutive monthly removal ratios together and then divide by twelve. This is your running annual average.
4. If the running annual average for TOC removal ratios is greater than or equal to 1.0, the facility is in compliance with the treatment technique.

An example of a TOC removal compliance calculation is provided below.

Month & Year	A Source Water TOC (mg/L)	B Treated Water TOC (mg/L)	C TOC Removal Achieved $((A-B) \div A) \times 100$	D Source Water Alkalinity (mg/L)	E Required TOC Removal % from 3X3 Matrix	F TOC Removal Ratio (C ÷ E)
Jan. '04	3.8	2.8	26.3%	121	15%	1.7

Month	TOC Removal Monthly Avgs.	Reporting the TOC Removal Ratio to the Department
January 2004	1.7	<ul style="list-style-type: none"><li>◆ Report your Monthly removal ratios to the Department on a quarterly basis.</li><li>◆ Submit the quarterly RAA within 10 days of the end of each quarter</li><li>◆ For example, January-March 2004 results are due to the Department on April 10, 2004.</li><li>◆ The running annual average of removal ratios for TOC in this example is 1.35. Therefore, the system is in compliance with the TOC removal treatment technique.</li></ul>
February 2004	1.78	
March 2004	1.20	
April 2004	1.0	
May 2004	0.99	
June 2004	1.0	
July 2004	0.91	
August 2004	0.90	
September 2004	1.24	
October 2004	1.87	
November 2004	2.31	
December 2004	1.43	
TOC Removal Ratio Running Annual Average	Add the last 12 monthly removal ratios to calculate the RAA $1.7 + 1.78 + 1.2 + 1.0 + 0.99 + 1.0 + 0.91 + 0.90 + 1.24 + 1.87 + 2.31 + 1.43 = 16.33 \div 12$ (Most Recent Months) = 1.36	

**Forms:** Following are reporting forms which can be copied for use by systems in reporting their monitoring results to KDHE.

A handy EPA Quick Reference Guide on the Stage 1 DDBP Rule is posted at the end of this survival guide.

## Stage 1 Disinfectants & Disinfection Byproduct Rule Compliance Report

Account Number	System Name	Plant Name

<b>Reporting Period:</b>	____ Quarter 20____ (Data Collected From ____/____/20____ To ____/____/20____)
--------------------------	--

Total Trihalomethanes (TTHMs) MCL = 0.080 mg/L or 80 µg/L			
QUARTER / YEAR	SAMPLE DATE	RESULT (µg/L)	QUARTERLY AVERAGE (µg/L)
Running Annual Average (RAA) <i>Average of four (4) Quarterly Averages</i>			
Identify TTHM Sampling Location of Maximum Residence Time (MRT)			
Location/Address:			

Haloacetic Acids (HAA5) MCL = 0.060 mg/L or 60 µg/L			
QUARTER / YEAR	SAMPLE DATE	RESULT (µg/L)	QUARTERLY AVERAGE (µg/L)
Running Annual Average (RAA) <i>Average of four (4) Quarterly Averages</i>			
Identify HAA5 Sampling Location of Maximum Residence Time (MRT)			
Location/Address:			

Maximum Residual Disinfectant Levels (MRDLs) (Systems Using Chlorine or Chloramines) MRDL = 4.0 mg/L			
MONTH / YEAR	NUMBER OF SAMPLES COLLECTED	NUMBER OF SAMPLES REQUIRED	MONTHLY AVERAGE (mg/L)
Running Annual Average (RAA) <i>Average of 12 Monthly Averages</i>			

Which Disinfectant is Used to Maintain Residual?	Chlorine	Chloramines
--	----------	-------------

**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Send Compliance Reports to: KDHE; c/o Ron Cramer; 1000 SW Jackson, Suite 420; Topeka, KS 66612

## Stage 1 Disinfectants & Disinfection Byproduct Rule Compliance Report

Account Number	System Name	Plant Name

<b>Reporting Period:</b>	___ Quarter 20___ (Data Collected From ___/___/20___ To ___/___/20___)
--------------------------	--

Total Trihalomethanes (TTHMs) MCL = 0.080 mg/L or 80 µg/L					
QUARTER / YEAR	Location 1 (µg/L)	Location 2 (µg/L)	Location 3 (µg/L)	Location 4 (MRT) (µg/L)	QUARTERLY AVERAGE (µg/L)
Running Annual Average (RAA) <i>Average of four (4) Quarterly Averages</i>					
Identify TTHM Sampling Location of Maximum Residence Time (MRT)					
Location/Address: _____					

Haloacetic Acids (HAA5) MCL = 0.060 mg/L or 60 µg/L					
QUARTER / YEAR	Location 1 (µg/L)	Location 2 (µg/L)	Location 3 (µg/L)	Location 4 (MRT) (µg/L)	QUARTERLY AVERAGE (µg/L)
Running Annual Average (RAA) <i>Average of four (4) Quarterly Averages</i>					
Identify HAA5 Sampling Location of Maximum Residence Time (MRT)					
Location/Address: _____					

Maximum Residual Disinfectant Levels (MRDLs) (Systems Using Chlorine or Chloramines) MRDL = 4.0 mg/L			
MONTH / YEAR	NUMBER OF SAMPLES COLLECTED	NUMBER OF SAMPLES REQUIRED	MONTHLY AVERAGE (mg/L)
Running Annual Average (RAA) <i>Average of 12 Monthly Averages</i>			

Which Disinfectant is Used to Maintain Residual?	<b>Chlorine</b>		<b>Chloramines</b>
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**Signature:** \_\_\_\_\_ **Date:** \_\_\_\_\_

Send Compliance Reports to: KDHE; c/o Ron Cramer; 1000 SW Jackson, Suite 420; Topeka, KS 66612

**Stage 1 Disinfectants & Disinfection Byproduct Rule Compliance Report**  
**Chlorine Dioxide and Chlorite Compliance Monitoring**

Account Number	System Name	Plant Name

<b>Reporting Period:</b> ____ Quarter 20____ (Data Collected From ____/____/20____ To ____/____/20____)
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<b>MONTH / YEAR:</b>	
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Chlorine Dioxide 0.8 mg/L MRDL Daily @ POE (required) & 3-sample set at 1st customer, ART, & MRT (only required if daily MRDL exceeded)				Chlorite 1.0 mg/L MCL Daily @ POE (required) & 3-sample set at 1st customer, ART, & MRT (required to be analyzed in a certified laboratory)		
Daily @ POE	POE Results (mg/L)	Follow-up (Yes or No)	Follow-up Results (mg/L)	Daily @ POE	POE Results (mg/L)	Date of 3-sample Set (Required)
1				1		
2				2		
3				3		
4				4		
5				5		
6				6		
7				7		
8				8		
9				9		
10				10		
11				11		
12				12		
13				13		
14				14		
15				15		
16				16		
17				17		
18				18		
19				19		
20				20		
21				21		
22				22		
23				23		
24				24		
25				25		
26				26		
27				27		
28				28		
29				29		
30				30		
31				31		

Comments: \_\_\_\_\_

Location	Address	Result (mg/L)
1st Customer		
ART		
MRT		
Average		

# CONTROL of DISINFECTION PRECURSORS

## Total Organic Carbon (TOC) Compliance Monitoring Report Form

Account #	System Name	Plant Name

Reporting Period: ____ Quarter 20____ (Data Collected From ____/____/20____ to ____/____/20____)							
	A	B	C	D	E	F	G
MONTH & YEAR	SOURCE WATER TOC (mg/L)	TREATED WATER TOC (mg/L)	TOC REMOVAL ACHIEVED (%) {(A-B) ÷ A} × 100	SOURCE WATER ALKALINITY (mg/L)	REQUIRED TOC REMOVAL (%) (From 3X3 Matrix)	ALTERNATIVE CRITERION1	TOC REMOVAL RATIO (C ÷ E)
			Running Annual Average (RAA) - Avg. of 12 monthly removal ratios <i>In compliance if Value is ≥ 1.0</i>				

Required % Removal of TOC (3X3 Matrix)			
Source Water TOC (mg/L)	Source Water Alkalinity, mg/L as CaCO <sub>3</sub>		
	0 - 60	> 60 - 120	> 120
> 2.0 to 4.0	35%	25%	15%
> 4.0 to 8.0	45%	35%	25%
> 8.0	50%	40%	30%

Systems practicing softening must meet the TOC removal requirements in the last column to the right

<sup>1</sup> If you use one of the 6 alternate criteria (see instructions) that allows you to report a ratio of 1.0 for a given month, show which one it is and why it applies. Be sure to calculate the actual ratio before using an alternative (in case it's > 1.0).  
If you use alternative criteria 5 or 6, which apply only to plants that soften, supply the data to support your decision. That would be magnesium removal for alternative 5 (at least 10 mg/L) or finished water alkalinity (< 60 mg/L) for alternative 6.





# Stage 1 Disinfectants and Disinfection Byproducts Rule: A Quick Reference Guide

## Overview of the Rule

Title	Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR) 63 FR 69390 - 69476, December 16, 1998, Vol. 63, No. 241
	Revisions to the Interim Enhanced Surface Water Treatment Rule (IESWTR), the Stage 1 Disinfectants and Disinfection Byproducts Rule (Stage 1 DBPR), and Revisions to State Primacy Requirements to Implement the Safe Drinking Water Act (SDWA) Amendments 66 FR 3770, January 16, 2001, Vol 66, No. 29
Purpose	Improve public health protection by reducing exposure to disinfection byproducts. Some disinfectants and disinfection byproducts (DBPs) have been shown to cause cancer and reproductive effects in lab animals and suggested bladder cancer and reproductive effects in humans.
General Description	The Stage 1 DBPR is the first of a staged set of rules that will reduce the allowable levels of DBPs in drinking water. The new rule establishes seven new standards and a treatment technique of enhanced coagulation or enhanced softening to further reduce DBP exposure. The rule is designed to limit capital investments and avoid major shifts in disinfection technologies until additional information is available on the occurrence and health effects of DBPs.
Utilities Covered	The Stage 1 DBPR applies to all sizes of community water systems and nontransient noncommunity water systems that add a disinfectant to the drinking water during any part of the treatment process and transient noncommunity water systems that use chlorine dioxide.

## Public Health Benefits

Implementation of the Stage 1 DBPR will result in . . .	<ul style="list-style-type: none"><li>▶ As many as 140 million people receiving increased protection from DBPs.</li><li>▶ 24 percent average reduction nationally in trihalomethane levels.</li><li>▶ Reduction in exposure to the major DBPs from use of ozone (DBP = bromate) and chlorine dioxide (DBP = chlorite).</li></ul>
Estimated impacts of the Stage 1 DBPR include . . .	<ul style="list-style-type: none"><li>▶ National capital costs: \$2.3 billion</li><li>▶ National total annualized costs to utilities: \$684 million</li><li>▶ 95 percent of households will incur an increase of less than \$1 per month.</li><li>▶ 4 percent of households will incur an increase of \$1-10 per month.</li><li>▶ &lt;1 percent of households will incur an increase of \$10-33 per month.</li></ul>

## Critical Deadlines and Requirements

### For Drinking Water Systems

January 1, 2002	Surface water systems and ground water systems under the direct influence of surface water serving $\geq$ 10,000 people must comply with the Stage 1 DBPR requirements.
January 1, 2004	Surface water systems and ground water systems under the direct influence of surface water serving < 10,000, and all ground water systems must comply with the Stage 1 DBPR requirements.

### For States

December 16, 2000	States submit Stage 1 DBPR primacy revision applications to EPA (triggers interim primacy).
December 16, 2002	Primacy extension deadline - all states with an extension must submit primacy revision applications to EPA.



### For additional information on the Stage 1 DBPR

Call the Safe Drinking Water Hotline at 1-800-426-4791; visit the EPA web site at [www.epa.gov/safewater](http://www.epa.gov/safewater); or contact your State drinking water representative.

Additional material is available at [www.epa.gov/safewater/mdbp/implement.html](http://www.epa.gov/safewater/mdbp/implement.html).

## Regulated Contaminants/Disinfectants

Regulated Contaminants	MCL (mg/L)	MCLG (mg/L)	Regulated Disinfectants	MRDL* (mg/L)	MRDLG* (mg/L)
Total Trihalomethanes (TTHM)	0.080		Chlorine	4.0 as Cl <sub>2</sub>	4
Chloroform Bromodichloromethane Dibromochloromethane Bromoform		- zero 0.06 zero			
Five Haloacetic Acids (HAA5)	0.060		Chloramines	4.0 as Cl <sub>2</sub>	4
Monochloroacetic acid Dichloroacetic acid Trichloroacetic acid Bromoacetic acid Dibromoacetic acid		- zero 0.3 - -	Chlorine dioxide	0.8	0.8
Bromate (plants that use ozone)	0.010	zero	*Stage 1 DBPR includes maximum residual disinfectant levels (MRDLs) and maximum residual disinfectant level goals (MRDLGs) which are similar to MCLs and MCLGs, but for disinfectants.		
Chlorite (plants that use chlorine dioxide)	1.0	0.8			
Treatment Technique					
Enhanced coagulation/enhanced softening to improve removal of DBP precursors (See Step 1 TOC Table) for systems using conventional filtration treatment.					

## Step 1 TOC Table - Required % Removal of TOC

Source Water TOC (mg/L)	Source Water Alkalinity, mg/L as CaCO <sub>3</sub>		
	0-60	> 60-120	> 120
> 2.0 to 4.0	35.0%	25.0%	15.0%
> 4.0 to 8.0	45.0%	35.0%	25.0%
> 8.0	50.0%	40.0%	30.0%

<sup>1</sup> Systems meeting at least one of the alternative compliance criteria in the rule are not required to meet the removals in this table.

<sup>2</sup> Systems practicing softening must meet the TOC removal requirements in the last column to the right

## Routine Monitoring Requirements

	Coverage	Monitoring Frequency	Compliance
TTHM/HAA5	Surface and ground water under the direct influence of surface water serving $\geq 10,000$	4/plant/quarter	Running annual average
	Surface and ground water under the direct influence of surface water serving 500 - 9,999	1/plant/quarter	Running annual average
	Surface and ground water under the direct influence of surface water serving < 500	1/plant/year in month of warmest water temperature**	Running annual average of increased monitoring
	Ground water serving $\geq 10,000$	1/plant/quarter	Running annual average
	Ground water serving < 10,000	1/plant/year in month of warmest water temperature**	Running annual average of increased monitoring
Bromate	Ozone plants	Monthly	Running annual average
Chlorite	Chlorine dioxide plants	Daily at entrance to distribution system; monthly in distribution system	Daily/follow-up monitoring
Chlorine dioxide	Chlorine dioxide plants	Daily at entrance to distribution system	Daily/follow-up monitoring
Chlorine/Chloramines	All systems	Same location and frequency as TCR sampling	Running annual average
DBP precursors	Conventional filtration	Monthly for total organic carbon and alkalinity	Running annual average

\*\* System must increase monitoring to 1 sample per plant per quarter if an MCL is exceeded.